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Department of Geology
Princeton University
Princeton, N.J.

May 20, 1965

To: Office of Space Sciences
National Aeronautics and Space Administration
Att'n: Dr. T.L.K. Smull
Director, Grants and Research Contracts

Subject: Progress Report on Grant NSG-556
Application of the Law of Solid Creep to Convective Motions in the Earth's Mantle, the Moon, and Planets

Subject grant has served to pay the salaries of two post-doctoral Research Associates both of whom have by now produced significant contributions.

It was decided in the beginning to approach the actual non-linear creep law at first by two linear laws, namely:

(A) Elastic deformation. This was treated by Dr. Bernard Durney who wrote two reports:

✓ (1) Deformation of a Purely Elastic Earth Model under Various Tectonic Loads.....April 1, 1964

✓ (2) Equilibrium Configurations between Density and Topographic Surface Irregularities in a purely Elastic Earth Model.....October 1, 1964

Dr. Durney left us at the completion of the second report to accept a position at the National Center for Atmospheric Research in Boulder.

Dr. Durney has since informed me that Report #1 has been accepted for publication by the Geophysical Journal (British), one of the oldest and best periodicals in the field.

(B) Viscous deformation (Newtonian viscosity). Dr. Jason Morgan, a graduate of our Physics Department has been with us since the winter of 1963/64. He was originally supported by a NSF grant supervised by the undersigned but was switched to the subject NASA grant early this year. He has just finished a report of which copies have been sent to you under separate cover. It is being sent for publication to the Journal of Geophysical Research after being broken down into two separate papers covering Theory and Applications respectively.

The title of the Report is: A Viscous Model of the Earth compared to Gravity Anomalies and Seismic Refraction Profiles of Oceanic Trenches and Ridges. April 30, 1965.

Dr. Morgan has accomplished this work with a minimum of supervision. It expresses the contour variations and gravity anomalies observed at the surface of the earth, or the moon say, as function of the viscous downdraft produced by material being somewhat heavier underneath. It relates the forces engendered by the heavier material in a quantitative manner to the observed surface anomalies. The theory is then checked against data from oceanic trenches.

I believe that this is an extraordinarily valuable piece of work, containing analysis of unusual quality and penetrating applications. It will certainly be applied and discussed

extensively by geophysicists. We are proud to be associated with this work.

Walter M. Elsasser

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Principal Investigator